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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

9401753

94-RPS-186

APR 07 1994

RECEIVED
APR 25 1994
CORRESPONDENCE CONTROL

Mr. Jerry Leitch, Chief
Radiation and Indoor Air Section
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Leitch:

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FEDERAL FACILITY COMPLIANCE AGREEMENT: STACK DESIGNATION OF 296-A-25, 296-B-28, 296-C-5, 296-S-22, AND 296-T-18

Existing and future transfers of radiological inventories to tanks which exhaust through five Tank Farm stacks: 296-A-25, 296-B-28, 296-C-05, 296-S-22, and 296-T-18, will cause these stacks to have potential airborne emissions in excess of 0.1 millrem/year (mrem/yr) to the maximally exposed individual (see enclosed assessments). Because the dose exceeds 0.1 mrem/yr, these stacks will require continuous monitoring in accordance with the 40 Code of Federal Regulations (CFR) Part 61, Subpart H.

Stack	Potential Dose (mrem/yr)
296-A-25	0.11
296-B-28	0.44
296-C-05	0.13
296-S-22	0.34
296-T-18	0.38

The U.S. Department of Energy, Richland Operations Office is requesting that the stacks be added to the list of "designated stacks" in Appendix B of the Federal Facility Compliance Agreement (FFCA). In accordance with the FFCA, these stacks will also require a point by point comparison of their sampling systems with the requirements in 40 CFR Part 61, Subpart H. Since the Environmental Protection Agency, Region 10 has agreed that point by point comparisons will not have to be made for those stacks which provide a schedule for upgrading, either a point by point comparison or a schedule for upgrading the monitoring systems for these stacks will be provided to meet this milestone.

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Should you have any questions regarding this transmittal, please call me or Mr. Steve Stites of my staff at (509) 376-8566.

Sincerely,

James D. Bauer, Program Manager
Office of Environmental Assurance,
Permits, and Policy

EAP:SDS

Enclosure:
Assessments of Stacks 296-A-25,
296-B-28, 296-C-05, 296-S-22,
and 296-T-18

cc w/o encl:
L. P. Diediker, WHC
B. G. Erlandson, WHC

cc w/encl:
A. W. Conklin, DOH
R. W. Poeton, EPA

Enclosure
Consisting of 10 pages

Assessments of Stacks 296-A-25, 296-B-28, 296-C-05, 296-S-22 and 296-T-18

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT
***

FACILITY 244-A DCRT DISCHARGE POINT Stack 296-A-25

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	3.98E-02	1.00E-03	3.98E-05	1.04E-07
2. Co-60	Particulate	9.84E+01	1.00E-03	9.84E-02	2.85E-03
3. Se-79 (1)	Particulate	7.97E-11	1.00E-03	7.97E-14	3.49E-15
4. Sr-89/90	Particulate	1.08E-06	1.00E-03	1.08E-09	4.73E-11
5. Y-90 (2)	Particulate	1.08E-06	1.00E-03	1.08E-09	4.07E-13
6. Tc-99	Particulate	7.97E-09	1.00E-03	7.97E-12	8.69E-15
7. Ru/Rh-106	Gas (3)	2.58E-01	1.00E+00	2.58E-01	5.39E-03
8. Sb-125	Particulate	2.21E+01	1.00E-03	2.21E-02	9.17E-05
9. I-129	Gas	3.98E-12	1.00E+00	3.98E-12	1.16E-12
10. Cs-134	Particulate	4.87E+00	1.00E-03	4.87E-03	1.52E-04
11. Cs-137	Particulate	1.66E+05	1.00E-03	1.66E+02	3.97E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	7.74E+02	1.00E-03	7.74E-01	3.39E-02
15. Nat.U	Particulate	3.98E-01	1.00E-03	3.98E-04	1.13E-03
16. Np-237	Particulate	2.05E-05	1.00E-03	2.05E-08	2.44E-07
17. Pu-238	Particulate	7.75E+00	1.00E-03	7.75E-03	6.22E-02
18. Pu-239/240	Particulate	1.51E+02	1.00E-03	1.51E-01	1.31E+00
19. Pu-241	Particulate	3.23E+02	1.00E-03	3.23E-01	4.46E-02
20. Am-241	Particulate	1.18E+01	1.00E-03	1.18E-02	1.55E-01
21. Cm-242/244	Particulate	1.72E-10	1.00E-03	1.72E-13	1.19E-12

Method Used to Project Dose: CAP88 Total Dose: 5.58E+00
Operational Dose (4): 1.06E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: __ DESIGNATED X NON-DESIGNATED (5)

EVALUATOR _____ DATE 12/7/93

MANAGER, ENVIRONMENTAL _____ DATE 12-9-93

FACILITY MANAGER _____ DATE 12-8-93

QUALITY ASSURANCE _____ DATE 12/8/93

SUBJECT: 244-BX DCRT (STACK #296-B-28) POTENTIAL EMISSIONS CALCULATION

As a result of the planned transfer from BY Farm to 244-BX Double Contained Receiver Tank (DCRT) and based on the Potential Emissions calculation listed below, air emissions from stack 296-B-28 have the potential to exceed 0.1 mrem/yr.

POTENTIAL EMISSIONS CALCULATION

Transfer Details

WHEN:	March/April 1994		
QUANTITY:	TANK 102-BY:	22 kgal (83 kl)	(WHC-EP-0182-67, Oct 93).
(Pumpable Liquid)	TANK 109-BY:	57 kgal (216 kl)	" "
ACTIVITY:	TANK 102-BY:	4.20E-02 uCi/l (Sr89/90)	(WHC-SD-WM-TI-363, Rev 1)
		4.50E-02 uCi/l (Tc99)	" "
		2.20E-05 uCi/l (Cs137)	" "
	TANK 109-BY:	1.90E-02 uCi/l (Sr89/90)	" "
		9.00E-01 uCi/l (Tc99)	" "
		1.74E-05 uCi/l (Cs137)	" "

Conversion Factors

4.38E-02 mrem/Ci (Sr90) *	CAP88 for 200 East Area	(WHC-EP-0498)
1.09E-03 mrem/Ci (Tc99)	" "	
2.39E-02 mrem/Ci (Cs137)	" "	

* Assume all Sr reported in WHC-SD-WM-TI-363, Rev 1 is Sr90

1E-03 Emission Factor for liquids and particulate solids (40 CFR 61, App D)

Calculation

$$\text{POTENTIAL TRANSFER DOSE} = \text{Radionuclide Concentration} * \text{Quantity of Pumpable Liquid} * \text{CAP88 Conversion Factor} * \text{1E-03 Emission Factor}$$

$$\text{POTENTIAL OFFSITE DOSE} = \text{Potential Transfer Dose} * \frac{\text{DCRT Operational Volume Limit (25 kgal)}}{\text{Total Transfer Volume}}$$

TANK 102-BY (22 kgal (83 kl) Pumoable Liquid)			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL OFFSITE DOSE (mrem)
Sr89/90	4.20E-02	4.38E-02	0.002
Tc99	4.60E-02	1.09E-03	4.17E-05
Cs137	2.20E-05	2.39E-02	0.438

TANK 109-BY (57 kgal (215 kl) Pumoable Liquid)			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL OFFSITE DOSE (mrem)
Sr89/90	1.90E-02	4.38E-02	0.002
Tc99	9.00E-01	1.09E-03	2.11E-05
Cs137	1.74E-05	2.39E-02	0.397

TOTAL POTENTIAL TRANSFER DOSE	1.34 mrem
TOTAL POTENTIAL OFFSITE DOSE	0.44 mrem/yr

EVALUATOR _____ DATE 3/16/94

MANAGER, ENVIRONMENTAL _____ DATE 3-17-94

FACILITY MANAGER _____ DATE 3-22-94

QUALITY ASSURANCE _____ DATE 3.22-94

SUBJECT: CR-003 DCRT (STACK #296-C-5) POTENTIAL EMISSIONS CALCULATION

As a result of the planned transfer from C Farm to CR-003 Double Contained Receiver Tank (DCRT) and based on the Potential Emissions calculation listed below, air emissions from stack 296-C-5 have the potential to exceed 0.1 mrem/yr.

POTENTIAL EMISSIONS CALCULATION

Transfer Details

WHEN:	June/July 1994.		
QUANTITY:	TANK 102-C:	19 kgal (72 kl)	(WHC-EP-0182-67, Oct 93)
(Pumpable	TANK 107-C:	20 kgal (76 kl)	" "
Liquid)	TANK 110-C:	5 kgal (19 kl)	" "
ACTIVITY:	TANK 102-C:	1.51E+02 uCi/l (Co60)	(WHC-SD-WM-TI-365, Rev 1)
		1.90E-01 uCi/l (Sr89/90)	" "
		1.60E-01 uCi/l (Tc99)	" "
		1.60E-04 uCi/l (Cs137)	" "
		5.30E-00 uCi/l (Pu239/240)	" "
	TANK 107-C:	1.70E-03 uCi/l (Sr89/90)	" "
		8.10E-01 uCi/l (Tc99)	" "
		4.12E-04 uCi/l (Cs137)	" "
		4.62E-02 uCi/l (Pu239/240)	" "
		7.60E-01 uCi/l (Am241)	" "
	TANK 110-C:	8.38E-00 uCi/l (Sr89/90)	" "
		7.01E+01 uCi/l (Tc99)	" "
		2.43E-04 uCi/l (Cs137)	" "
		4.40E-01 uCi/l (Pu239/240)	" "

Conversion Factors

2.90E-02 mrem/Ci (Co60)	CAP9-88 for 200 East Area	(WHC-EP-0498)
4.38E-02 mrem/Ci (Sr90) *	" "	
1.09E-03 mrem/Ci (Tc99)	" "	
2.39E-02 mrem/Ci (Cs137)	" "	
8.67E+00 mrem/Ci (Pu239) **	" "	
8.66E-00 mrem/Ci (Pu240)	" "	
1.31E+01 mrem/Ci (Am241)	" "	

* Assume all Sr reported in WHC-SD-WM-TI-365, Rev 1 is Sr90.

** The analytical data does not identify the quantity of each Pu isotope. Therefore to be conservative, the Pu239 conversion factor was used.

1E-03 Emission Factor for liquids and particulate solids (40 CFR 61, App D)

Calculation

POTENTIAL TRANSFER DOSE = Radionuclide Concentration * Quantity of Pumpable Liquid * CAPP-88 Conversion Factor * 1E-03 Emission Factor

POTENTIAL OFFSITE DOSE = Total Potential Transfer Dose * DCRT Operational Volume Limit (13.5 kgal) / Total Transfer Volume

TANK 102-C (19 kgal (72 kl) Pumpable Liquid)			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL TRANSFER DOSE (mrem)
Co60	1.51E-02	2.90E-02	3.15E-04
Sr89/90	1.90E-01	4.38E-02	3.98E-05
Tc99	1.60E-01	1.09E-03	1.25E-06
Cs137	1.60E-04	2.39E-02	0.023
Pu239/240	5.30E-00	3.67E-00	0.004

TANK 107-C (20 kgal (76 kl) Pumpable Liquid)			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL TRANSFER DOSE (mrem)
Sr89/90	1.70E-03	4.38E-02	0.006
Tc99	8.10E-01	1.09E-03	6.68E-06
Cs137	4.12E-04	2.39E-02	0.075
Pu239/240	4.62E-02	3.67E-00	0.303
Am241	7.60E-01	1.31E-01	0.001

TANK 110-C (5 kgal (19 kl) Pumpable Liquid)			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL TRANSFER DOSE (mrem)
Sr89/90	8.38E+00	4.38E-02	6.95E-06
Tc99	7.01E+01	1.09E-03	1.45E-06
Cs137	2.43E+04	2.39E-02	0.011
Pu239/240	4.40E+01	8.67E+00	0.007

TOTAL POTENTIAL TRANSFER DOSE	0.433 mrem
TOTAL POTENTIAL OFFSITE DOSE	0.13 mrem

EVALUATOR _____ DATE 3/16/94

MANAGER, ENVIRONMENTAL _____ DATE 3-17-94

FACILITY MANAGER _____ DATE 3-22-94

QUALITY ASSURANCE _____ DATE 3-22-94

STACK ASSESSMENT FOR 40 CFR 61, SUBPART H
APPENDIX D SOURCE ASSESSMENT
***

FACILITY 244-S DCRT DISCHARGE POINT Stack 296-S-22

FACILITY RADIOLOGICAL INVENTORY AT RISK

Radionuclide	Physical/ Chemical Form	Quantity (curies)	Release Factor	Potential Quantity Released (curies)	Projected Dose (mrem/yr)
1. C-14	Particulate	6.46E-07	1.00E-03	6.46E-10	1.07E-12
2. Co-60	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
3. Se-79 (1)	Particulate	3.19E-09	1.00E-03	3.19E-12	8.29E-14
4. Sr-89/90	Particulate	2.73E+05	1.00E-03	2.73E+02	7.10E+00
5. Y-90 (2)	Particulate	2.73E+05	1.00E-03	2.73E+02	6.06E-02
6. Tc-99	Particulate	1.29E-07	1.00E-03	1.29E-10	8.32E-14
7. Ru/Rh-106	Gas (3)	1.22E-02	1.00E+00	1.22E-02	1.46E-04
8. Sb-125	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
9. I-129	Gas	2.24E-10	1.00E+00	2.24E-10	2.55E-11
10. Cs-134	Particulate	1.27E+00	1.00E-03	1.27E-03	2.36E-05
11. Cs-137	Particulate	2.32E+05	1.00E-03	2.32E+02	4.00E+00
12. Ce-144	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
13. Pm-147	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
14. Eu-154 (1)	Particulate	0.00E+00	1.00E-03	0.00E+00	0.00E+00
15. Nat.U	Particulate	9.46E-03	1.00E-03	9.46E-06	1.60E-05
16. Np-237	Particulate	2.24E-06	1.00E-03	2.24E-09	1.58E-08
17. Pu-238	Particulate	6.19E-02	1.00E-03	6.19E-05	2.95E-04
18. Pu-239/240	Particulate	6.85E+02	1.00E-03	6.85E-01	3.53E+00
19. Pu-241	Particulate	7.76E-01	1.00E-03	7.76E-04	6.34E-05
20. Am-241	Particulate	3.19E-01	1.00E-03	3.19E-04	2.49E-03
21. Cm-242/244	Particulate	1.35E-05	1.00E-03	1.35E-08	5.56E-08

Method Used to Project Dose: CAP88 Total Dose: 1.47E+01
Operational Dose (4): 3.40E-01

COMMENTS

1. Sr-90 used as the beta emitter; dose factors were not included in the radionuclide library for this specific radionuclide.

2: Y-90 is assumed to be in secular equilibrium with Sr-90.

3: This is a conservative estimate.

4: Incorporates volumetric and time factors based on projected usage.

5: This system is not currently transferring waste that would require a designated status for the stack.

STACK STATUS: __ DESIGNATED X NON-DESIGNATED (5)

EVALUATOR _____ DATE 12/7/93

MANAGER, ENVIRONMENTAL _____ DATE 12-9-93

FACILITY MANAGER _____ DATE 12-9-93

QUALITY ASSURANCE _____ DATE 12/9/93

SUBJECT: 244-TX DCRT (STACK #296-T-18) POTENTIAL EMISSIONS CALCULATION

As a result of the transfer from tank 101-T and five batch transfers from Z Plant, and based on the Potential Emissions Calculation listed below, air emissions from stack 296-T-18 have the potential to exceed 0.1 mrem/yr.

POTENTIAL EMISSIONS CALCULATION

Transfer Details

WHEN: The transfer from tank 101-T to 244-TX took place in Mar/Apr '93. Two batches have been transferred from Z Plant to the 244-TX DCRT so far this year. The contents of 244-TX were transferred to 102-SY, and the remaining batches from Z Plant are currently being accumulated in 244-TX for future transfer to 102-SY.

QUANTITY: TANK 101-T: 18,000 gallons (68,000 liters)
Z PLANT: 12,000 gallons total (45,420 l) (11,227 l first batch; 6,270 l second batch)

ACTIVITY: TANK 101-T: 6.04E-01 uCi/l (Sr89/90) (WHC-SD-WM-TI-365, Rev 1)
1.07E+02 uCi/l (Tc99) " "
9.36E-04 uCi/l (Cs137) " "
2.34E-01 uCi/l (Pu239/240) " "
1.13E-01 uCi/l (Am241) " "
Z PLANT: 139.56g Plutonium and 1.18g Am241 in the first batch; 81.2g Pu and 0.0752g Am241 in the second batch; and approximately 80-100g Pu in each of the remaining three batches. (Assume Pu is 90% Pu239 and 10% Pu240)

Conversion Factors

6.20E-02 Ci/g (Pu239) (SD-RE-TI-131)
2.27E-01 Ci/g (Pu240) " "
3.43E+00 Ci/g (Am241) " "

2.60E-02 mrem/Ci (Sr89/90) * CAPP-88 for 200 West Area (WHC-EP-0498)
6.45E-04 mrem/Ci (Tc99) " "
1.42E-02 mrem/Ci (Cs137) " "
5.15E+00 mrem/Ci (Pu239) ** " "
5.14E+00 mrem/Ci (Pu240) " "
7.79E+00 mrem/Ci (Am241) " "

* Assume all Sr reported in WHC-SD-WM-TI-365, Rev 1 is Sr 90

** The analytical data does not identify the quantity of each Pu isotope. Therefore, to be conservative the Pu239 conversion factor was used.

1E-03 Emission Factor for liquids and particulate solids (40 CFR 61, App D)

Calculation (TRANSFERS FROM Z PLANT)

AVERAGE Am241 CONCENTRATION:

1.18g Am241 / 11,227 l = 1.05E-04 g/l (first batch)

0.0752g Am241 / 6,270 l = 1.19E-05 g/l (second batch)

(1.05E-04 g/l + 1.19E-05 g/l) / 2 = 5.86E-05 g/l

ESTIMATED GRAMS Am241 IN REMAINING THREE BATCH TRANSFERS:

45,420 l - (6,270 l + 11,227 l) = 27,923 l

27,923 l * 5.86E-05 g/l = 1.64g Am241 (0.55g per batch)

TOTAL GRAMS Am241 FOR ALL FIVE BATCH TRANSFERS:

1.64 + 1.18 + 0.0752 = 2.90g Am241

TOTAL GRAMS Pu:

139.55 + 81.2 + 3 * 100 = 520.75g (468.68g Pu239, 52.07g Pu240)

Pu239 POTENTIAL TRANSFER DOSE:

468.68g * 6.20E-02 Ci/g * 5.15 mrem/Ci * 1E-03 = 0.150 mrem

Pu240 POTENTIAL TRANSFER DOSE:

52.07g * 2.27E-01 Ci/g * 5.14 mrem/Ci * 1E-03 = 0.061 mrem

Am241 POTENTIAL TRANSFER DOSE:

2.90g * 3.43 Ci/g * 7.79 mrem/Ci * 1E-03 = 0.077 mrem

Z PLANT POTENTIAL TRANSFER DOSE = 0.288 mrem

Calculation (TRANSFER FROM TANK 101-T)

POTENTIAL TRANSFER DOSE = Radionuclide Concentration * Quantity of Pumpable Liquid * CAPP-88 Conversion Factor * 1E-03 Emission Factor

TANK 101-T (18 kgal (68 kl))			
RADIONUCLIDE	CONCENTRATION (uCi/l)	CAPP-88 FACTOR (mrem/Ci)	POTENTIAL DOSE (mrem)
Sr89/90	5.04E-01	2.60E-02	8.91E-05
Tc99	1.07E-02	6.45E-04	4.69E-06
Cs137	9.36E-04	1.42E-02	0.090
Pu239/240	2.54E-01	5.15E-00	8.90E-05
Am241	1.13E-01	7.79E-00	5.99E-05
TANK 101-T POTENTIAL TRANSFER DOSE			0.090 mrem

POTENTIAL OFFSITE DOSE = (SUM OF POTENTIAL TRANSFER DOSES) * DCRT Operational Volume Limit (26 kgal) / Total Transfer Volume

TANK 101-T POTENTIAL TRANSFER DOSE	0.090
Z PLANT POTENTIAL TRANSFER DOSE	0.298
POTENTIAL OFFSITE DOSE	0.378 mrem/yr

EVALUATOR _____ DATE 3/16/94

MANAGER, ENVIRONMENTAL _____ DATE 3-21-94

FACILITY MANAGER _____ DATE 3-22-94

QUALITY ASSURANCE _____ DATE 3-22-94

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
James D. Bauer, RL (W. E. Davis, WHC)	Jerry Leitch, EPA Page 2 of 2	Incoming:9401753 Xref: 9301990B R22

Subject: NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FEDERAL FACILITY COMPLIANCE AGREEMENT: STACK DESIGNATION OF 296-A-25, 296-B-28, 296-C-5, 296-S-22, AND 296-T-18

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
		J. R. Kasper	R2-50	
		J. C. Krogness	L6-36	
		R. J. Landon	H6-21	
		J. Lohrasbi	S6-19	
		P. J. Mackey	B3-06	
		K. M. McDonald	T4-03	
		H. E. McGuire, Level I	B3-63	
		E. M. Megahed	T4-03	
		T. D. Miller	T7-05	
		J. H. Mizner	T3-28	
		J. M. Nickels	H6-22	
		D. G. Ranade	B2-16	
		J. H. Rasmussen	T7-20	
		J. W. Rich	N1-40	
		P. J. Sullivan	T5-54	
		H. R. Vogel	L6-40	
		R. D. Weissenfels	S6-70	
		EPIC	H6-08	
		WED File/LB	T1-30	

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
James D. Bauer, RL (W. E. Davis, WHC)	Jerry Leitch, EPA Page 1 of 2	Incoming:9401753 Xref: 9301990B R22

Subject: NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FEDERAL FACILITY COMPLIANCE AGREEMENT: STACK DESIGNATION OF 296-A-25, 296-B-28, 296-C-5, 296-S-22, AND 296-T-18

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
		Correspondence Control	A3-01	
		D. Alison	T5-54	
		J. M. Barnett	T1-30	
		J. A. Bates	H6-22	
		T. G. Beam	S6-70	
		S. M. Belisle	H6-20	
		L. T. Blackford	T3-28	
		R. J. Boom	T1-30	
		R. J. Bottenus	T3-28	
		M. J. Brown	H6-20	
		G. D. Carpenter	H6-30	
		G. M. Crummel	R1-51	
		N. R. Dahl	N2-04	
		N. E. Darling	H6-21	
		W. E. Davis	H6-20	
		L. P. Diediker	T1-30	
		W. T. Dixon, Assignee	H6-21	
		H. G. Doolittle	T3-28	
		J. J. Dorian	H6-30	
		J. H. Dunkirk	B3-06	
		R. H. Engelmann	H6-26	
		B. G. Erlandson	H6-20	
		G. W. Faulk	T3-28	
		P. J. Fortin	T6-12	
		K. A. Gano	XO-21	
		R. G. Gant	XO-41	
		C. J. Geier	R2-54	
		E. M. Greager	H6-30	
		W. T. Gretsinger	R4-01	
		R. D. Gustavson	R1-51	
		K. A. Hadley	R3-56	
		D. L. Halgren	S6-70	
		D. G. Hamrick	R1-51	
		D. R. Herman	S2-12	
		G. W. Jackson	H6-21	
		D. B. Jensen	H6-30	
		D. L. Johnson	S6-19	